

CLAIMS

1. A non-attached monitoring device for monitoring an engineering condition of a tire and transmitting data related to the engineering condition to a reader positioned outside of the tire; the tire having a sidewall that is an oriented attenuating body for the monitoring device; the oriented attenuating body having maximum and minimum attenuating levels; the non-attached monitoring device being loosely disposed within the tire; the monitoring device including a monitoring assembly and an antenna; wherein the improvement comprises:

the antenna having an orientation that radiates a transmission pattern; the transmission pattern having a portion that is attenuated by the oriented attenuating body of the tire sidewall at the minimum attenuating level regardless of the orientation of the monitoring device with respect to the tire sidewall.

2. The improvement of claim 1, wherein the antenna includes an antenna body that is looped back 180 degrees on itself.

3. The improvement of claim 2, wherein the monitoring assembly defines the ground plane of the antenna; the body of the antenna being disposed in a reference plane that is perpendicular to the ground plane.

4. The improvement of claim 2, wherein the monitoring assembly defines the ground plane of the antenna; the body of the antenna being disposed in a reference plane that is parallel to the ground plane.

5. The improvement of claim 2, wherein the monitoring assembly defines the ground plane of the antenna; the body of the antenna being disposed in a reference plane that is disposed at an angle between zero and 90 degrees to the ground plane.

6. The improvement of claim 1, wherein the monitoring device includes an antenna ground plane; the body of the antenna being disposed in a reference plane that is perpendicular to the ground plane.

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7. The improvement of claim 1, wherein the monitoring device includes antenna ground plane; the body of the antenna being disposed in a reference plane that is parallel to the ground plane.

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8. The improvement of claim 1, wherein the monitoring device includes antenna ground plane; the body of the antenna being disposed in a reference plane that is disposed at an angle between zero and 90 degrees to the ground plane.

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9. The improvement of claim 1, wherein the monitoring assembly and antenna are encapsulated within a rigid encapsulation layer.

10. The improvement of claim 1, wherein the antenna includes a pair of spaced, parallel conductive surfaces.

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11. The improvement of claim 10, wherein the monitoring device has a body that defines an outer surface; each of the conductive surfaces extending to the outer surface of the body of the monitoring device to define a slot.

5 12. The improvement of claim 10, wherein one of the conductive surfaces is electrically connected to the monitoring assembly.

10 13. The improvement of claim 12, wherein each of the conductive bodies is disc-shaped and has a center; the monitoring assembly being electrically connected to the conductive body at the center of the conductive body.

14. The improvement of claim 1, wherein the monitoring device has a body that defines an outer surface; the antenna including a pair of spaced conductive bodies that extend to the outer surface of the body to define a slot.

15 15. The improvement of claim 14, wherein the slot has a serpentine pattern.

16. The improvement of claim 15, wherein one of the conductive surfaces is electrically connected to the monitoring assembly.

20 17. The improvement of claim 1, wherein the antenna includes four spaced conductive bodies; each of the four conductive bodies having first and second planar leg portions with curved outer edges; the first planar leg portion being disposed perpendicular to the second planar leg portion.

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18. The improvement of claim 17, wherein the monitoring assembly is electrically connected to two of the conductive bodies.

5 19. A non-attached monitoring device for monitoring an engineering condition of an environment; the monitoring device including:

10 a body having an outer surface;

 a monitoring assembly disposed within the body; and

 an antenna electrically connected to the monitoring assembly; the antenna including an antenna body that is looped back on itself through a 180 degree arc.

15 20. The monitoring device of claim 19, further comprising a ground plane for the antenna; the antenna body being disposed in a reference plane that is perpendicular to the ground plane.

20 21. The monitoring device of claim 19, further comprising a ground plane for the antenna; the antenna body being disposed in a reference plane that is parallel to the ground plane.

25 22. A non-attached monitoring device for monitoring an engineering condition of an environment; the monitoring device including:

 a body having an outer surface;

 a monitoring assembly disposed within the body; and

 an antenna electrically connected to the monitoring assembly; the antenna including at least two spaced conductive bodies that each extend to

the outer surface of the body to form a continuous slot at the outer surface of the body.

23. The monitoring device of claim 22, wherein the slot is circular.

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24. The monitoring device of claim 22, wherein the slot is serpentine.